TEACHING INTRODUCTORY STATISTICS WITH IN-CLASS DATA COLLECTION

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GAISE Recommendations

- 1:Emphasize statistical literacy and develop statistical thinking.
- 2:Use real data.
- 3: Stress conceptual understanding, rather than mere knowledge of procedures.

GAISE Recommendations

- 4: Foster active learning in the classroom.
- 5: Use technology for developing concepts and analyzing data.
- 6: Use assessments to improve and evaluate student learning.

Naked, Realistic, & Real Data

- Naked Data – Made-up data with no context.
- Example: Find the correlation coefficient

X	Y
1	3
2	2
3	1

Naked, Realistic, & Real Data

- Realistic – Context added to Made-up data
- Example: Simpson's Paradox Lesson*

	Helicopter	Ambulance
Victim died	64	260
Victim survived	136	840
Total	200	1100

Naked, Realistic, & Real Data

Serious	Helicopter	Ambulance
Victim died	48	60
Victim survived	52	40
Total	100	100

Less serious	Helicopter	Ambulance
Victim died	16	200
Victim survived	84	800
Total	100	1000

Naked, Realistic, & Real Data

- Real – Data from a real situation that is of interest to students.
- Example:

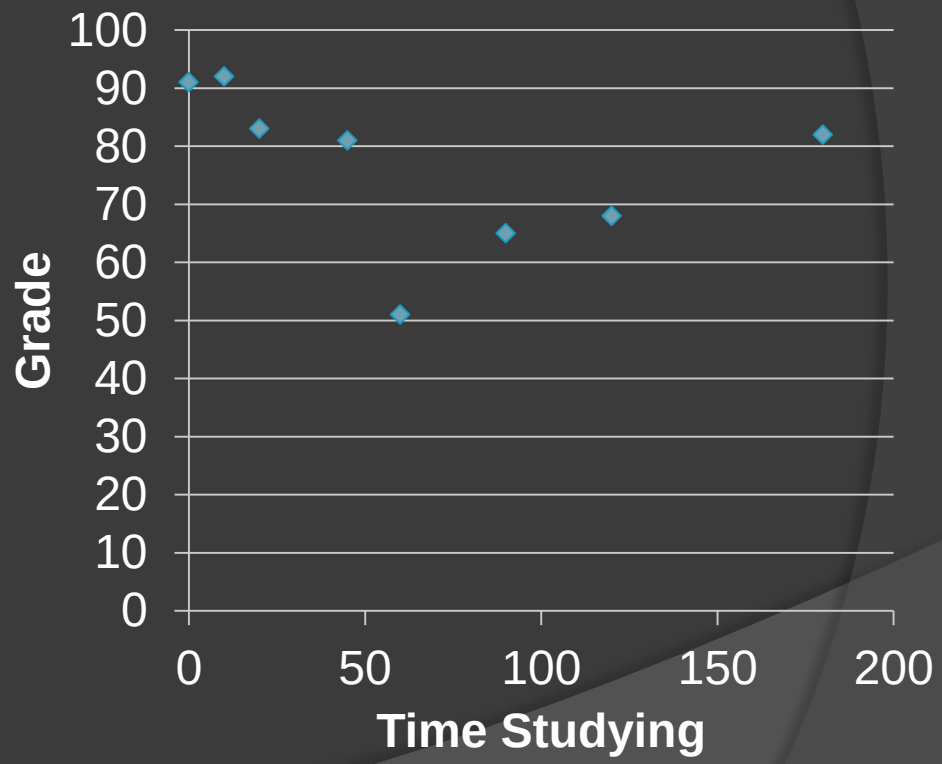
Age Boys First Ride an ATV

Rural	**2**	**3**	**8**	**3**	**6**	**5**	**2**	**2**	**16**
Urban	5	4	3	5	12	10	8		

Examples for Regression

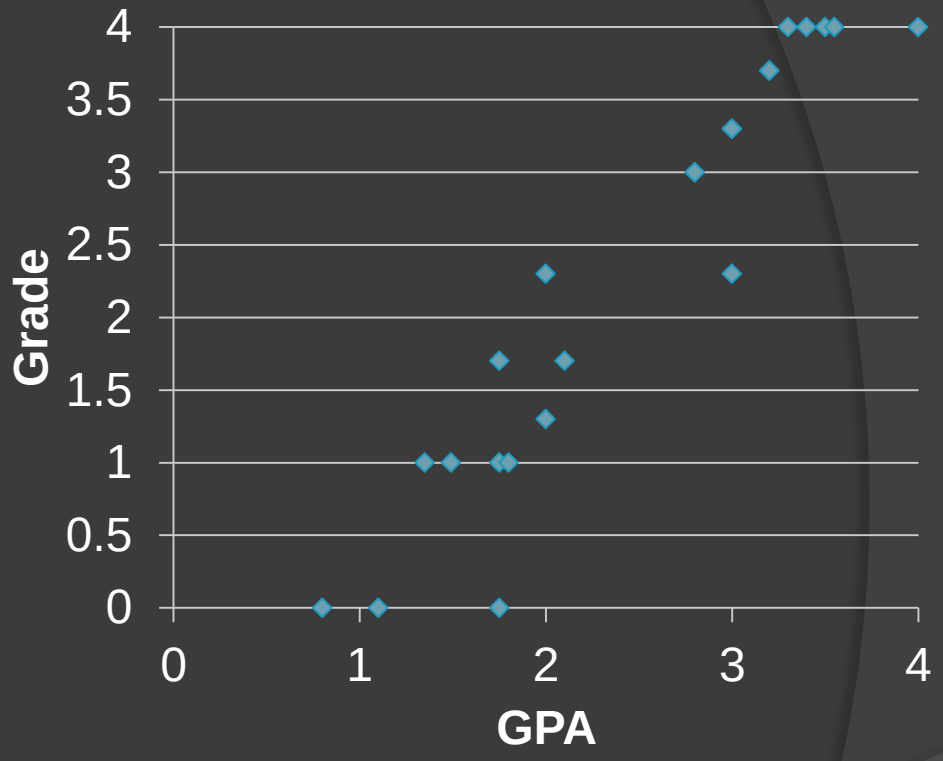
- Grade on Exam vs. Study Time

Time Studying (minutes)	Grade (out of 100)
0	91
90	65
120	68
10	92
60	51
180	82
20	83
45	81



Examples for Regression

- Cumulative GPA vs. Course Grade
- Age vs. Number of Parking Tickets/Car Accidents
- Number of Cars Owned vs. Number of Cars Wrecked



Examples for Hypothesis Testing

- Rolling dice
  - Also good for Law of Large Numbers and Central Limit Theorem
- Poker chips out of a bag

Examples for Z-Test, T-Test

- How many children do you want to have? ($\mu = 2.5$)
- How many bicycles have you owned in your lifetime? ($\mu = 3$, $\sigma = 1.3$)
- How many pets do you own?
- What is the ideal age to get married?

  ($\mu = 27$ women, $\mu = 29$ men[2])
  *skewed

[2] http://en.wikipedia.org/wiki/Age_at_first_marriage

Examples for 2-Sample T-Test

- At what age did you first ride an ATV? Rural vs. Urban

Age Boys First Ride an ATV

Rural	**2**	**3**	**8**	**3**	**6**	**5**	**2**	**2**	**16**
Urban	5	4	3	5	12	10	8		

- Any Z/T – Test example divided by gender.

Examples for Proportions or Binomial Distributions

- Do you support vaccinations for all children?
- Would you report cheating to a professor?
- Do you live on-campus? (p = ? your campus)
- Do you have a car? (p = .95[1])

[1]http://photos.state.gov/libraries/cambodia/30486/Publications/everyone_in_america_own_a_car.pdf

Examples for Two-Way Tables

- How often do you use Facebook?
  - More than once a day, Once a day, Several times a week, Once a week, Less than once a week
- Where were you raised?
  - Rural, Urban, Suburban
- Have you ever broken a bone? Or, how many bones have you broken?
- Grade level?
  - Freshmen, Sophomore, Junior, Senior

How to collect data:

- Go around the room and ask
- Slips of paper
- With other work
- Student demonstration
- Beginning of the semester survey (could be online)
- Websites
  - http://www.worldometers.info/
  - http://lib.stat.cmu.edu/DASL/
  - http://iase-web.org/Links.php?p=Datasets
  - http://www.amstat.org/publications/jse/jse_data_archive.htm

Warnings

- Anonymous/Confidential
- Nice numbers are nice sometimes (Simpson’s paradox)
- Be prepared for wild p-values
- Be prepared for outliers and be able to compare results without them

Technology

- TI Calculators
- Excel
- Online Resources/Applets

References

- Aliaga, M., Cobb, G., Cuff, C., Garfield, J., Gould, R., Lock, R., Moore, T., Rossman, A., Stephenson, R., Utts, J., Velleman, P., and Witmer, J. (2005), “Guidelines for assessment and instruction in statistics education: College report,” Alexandria, VA: American Statistical Association. Retrieved from http://www.amstat.org/education/gaise
- Moore,D. (2010). *The Basic Practice of Statistics (*5th ed.). New York, NY: W.H. Freeman and Company.